REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS
LOCHSA RIVER BULL TROUT

DISTRIBUTION, ABUNDANCE AND LIFE HISTORY CHARACTERISTICS OF BULL AND BROOK TROUT IN THE LOCHSA RIVER BASIN

Annual Report
2004

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USDA Forest Service
Contract Number 00-CS-11010500-015

IDFG 05-52
December 2005

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ABSTRACT

Hook and line sampling was used to capture a total of 43 bull trout *Salvelinus confluentus* in the Lochsa River, 2004. Total length of these fish ranged from 330 - 568 mm (mean 444.5 mm) and weight ranged from 330 – 1,810 g (mean 898.6 g). Of the total captured, 41 were radio-tagged and 83% of the radio-tagged fish were documented migrating into spawning tributaries. The highest number of radio-tagged bull trout migrated into the Colt Killed Creek drainage, including Storm Creek. This area contained 45% of all radio-tagged bull trout during the spawning time period. These fish migrated a mean upstream distance of 74.4 km (range: 25.3 km -124.1 km). We also investigated the distribution and abundance of the salmonid fish community in Fish Creek. Steelhead/rainbow trout *Oncorhynchus mykiss* and Westslope cutthroat trout *O. clarki lewisi* represented 77% and 23% of the salmonid community, respectively. All steelhead/rainbow trout were less than 305 mm in total length and they were concentrated in the lower 10 km of Fish Creek. These fish are believed to be wild juvenile steelhead trout. No bull trout or brook trout (*S. fontinalis)* were observed in Fish Creek.

INTRODUCTION

In 1998 bull trout *Salvelinus confluentus* were listed in the Columbia River drainage as threatened under the Endangered Species Act. Reasons for their decline include: habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest, entrainment, and competition from non-native species.

In 2002, the draft recovery plan described processes to reduce threats to the long-term survival and reverse the decline of the species (U.S. Fish and Wildlife Service 2002, Chapter 1). The Columbia River drainage was broken into 22 recovery units, areas where bull trout share genetic characteristics as well as management jurisdictions. Recovery units contain one or more core areas (areas that contain local populations of bull trout and are partially isolated but have some degree of gene flow among them. Local populations are defined as groups of bull trout that spawn in various tributaries but are generally characterized by small amounts of genetic diversity within a tributary but high levels of genetic divergence between tributaries (Leary et al. 1993). Local populations are considered to be the smallest group of bull trout known to represent an interacting reproductive unit (U.S. Fish and Wildlife Service 2002, Chapter 1).

The draft recovery plan lists 7 core areas and 45 local populations in the Clearwater River drainage (U.S. Fish and Wildlife Service 2002, Chapter 16). In addition to the local populations 27 potential local populations were identified. Potential local populations are areas known or suspected to be unoccupied, but have the potential to provide spawning and rearing habitat for bull trout and support a local population in the future. Furthermore, the draft recovery plan considers 18 of the 27 potential populations as essential to recovery because they are considered to be central to recovery objectives. According to the recovery plan, in order for bull trout in a core area to be considered at diminished risk of extinction, recovery plan criteria requires each of its core areas to contain at least 1,000 adult spawners, and a minimum of 10 local populations (U.S. Fish and Wildlife Service 2002, Chapter 1).

The Lochsa River Drainage is one of the seven core areas in the Clearwater River Recovery Unit. The recovery plan identifies 16 known local populations in the Lochsa core area. The local populations include: Fishing, Legendary Bear, Fox, Shotgun, Crooked Fork, Boulder, Haskell, Rock, Brushy Fork, Spruce, Twin, Colt Killed, Beaver, and Storm creeks. The recovery plan also categorizes nine potential populations essential to recovery in the Lochsa core area:

Post Office, Weir, Indian Grave, Lake, Boulder, Old Man, Hungry, Fish, and Split creeks. The recovery criteria for the Lochsa River Drainage is 16 local and 9 potential populations, with 5,000 total adults, and a trend of stable to increasing for 15 years (U.S. Fish and Wildlife Service 2002, Chapter 16).

To date, little information is known about adult bull trout numbers or trends in abundance in the Lochsa River Drainage except for redd counts conducted by the Clearwater National Forest (Pat Murphy, Personal Communication, USDA Forest Service, Clearwater National Forest). Additionally little is known about the distribution or abundance of bull trout in streams listed as "potential essential" local populations.

Bull trout populations in the Lochsa River are at risk for impact by many of the reasons listed as contributing to bull trout declines including introduced non-native species. Introduced brook trout *Salvelenus fontinalis* can potentially have a negative impact on resident salmonids, particularly bull trout that share similar microhabitats and spawn at similar times of the year. These species have not evolved in sympatry and are found to use similar niches, competing strongly for limited resources (Nakano et al. 1998). In an Oregon stream non-native brook trout were clearly observed to be aggressive and dominant over bull trout of similar size, displacing them to other areas of the stream (Gunckel et al. 2002). The extent to which brook trout have impacted bull trout or limit their recovery is unknown in the Lochsa River, and other core areas within the Clearwater Recovery Unit.

The goals of this project were to document bull trout distribution, migration patterns, and identify previously unknown spawning locations. The second goal of this project was to document the presence and distribution of bull trout and brook trout in Fish Creek, a potential local population listed as essential to recovery.

OBJECTIVES

1. Obtain basic biological and life history information on bull trout in the Lochsa, Middle Fork Clearwater (Middle Fork), and Clearwater rivers (CWR).

2. Determine migration patterns of bull trout within the Lochsa, Middle Fork, and CWR rivers.

3. Document the presence, distribution, and abundance of salmonids, specifically bull trout in Fish Creek.

Study Area

The CWR is a sixth order stream in north-central Idaho. The CWR extends from its confluence with the Snake River, at Lewiston, Idaho, east to its confluence with the South Fork Clearwater River (South Fork) at Kooskia, Idaho (Figure 1). Major tributaries to the CWR include the North Fork Clearwater River (North Fork) (rkm 64.8), the South Fork (rkm 119.5) and the Middle Fork (rkm 119.5). In this document, river kilometers are calculated from 0.0 rkm at the Snake and CWR river confluence. The NF extends east 3.1 km to the base of Dworshak Dam. Dworshak Dam was constructed in 1971 without fish passage facilities, and is a permanent upstream migration barrier. Upstream of Dworshak Dam is Dworshak Reservoir and the remainder of the North Fork. Dworshak Reservoir and the North Fork is a fifth order stream with

a total drainage area of 739,982 ha. The Middle Fork extends from the mouth of the South Fork near Kooskia, Idaho (rkm 119.5), east to the confluence of the Lochsa and Selway rivers (rkm 156.2) at Lowell, Idaho. The Lochsa River is a fifth order stream with a total drainage area of 306,254 ha (Figure 1).

The Lochsa River extends east to the Bitterroot Mountains on the Idaho-Montana Border. The majority of the land in the watershed is under public ownership and more than 60% of the drainage is designated as wilderness or roadless. The primary private landowner in the drainage is Plum Creek Timber Company. Major tributaries include: Brushy Fork, Colt Killed, Crooked Fork, Walton, Shotgun, Fishing, Legendary Bear, Post Office, Warm Springs, Lake, Split, Stanley, Boulder, Old Man, Fish, Deadman, and Pete King creeks (Figure 1).

Fish Creek is a third order tributary to the Lochsa River with a total drainage area of 22,579 ha. Fish Creek drains from the north side of the Lochsa River drainage, entering the Lochsa River at rkm 195.9. Major tributaries include: Alder, Ceanothus, Frenchman, Willow, and Hungery creeks (Figure 2). Little is known on the species composition or abundance in Fish Creek. Idaho Department of Fish and Game (Department) completes annual snorkel monitoring in designated transects below Hungery Creek; however above this tributary there are no population inventories completed. Also, the Department operates an adult fish weir and juvenile screw trap approximately 1.3 km above the mouth of Fish Creek. Juvenile and adult bull trout have been captured at these facilities.

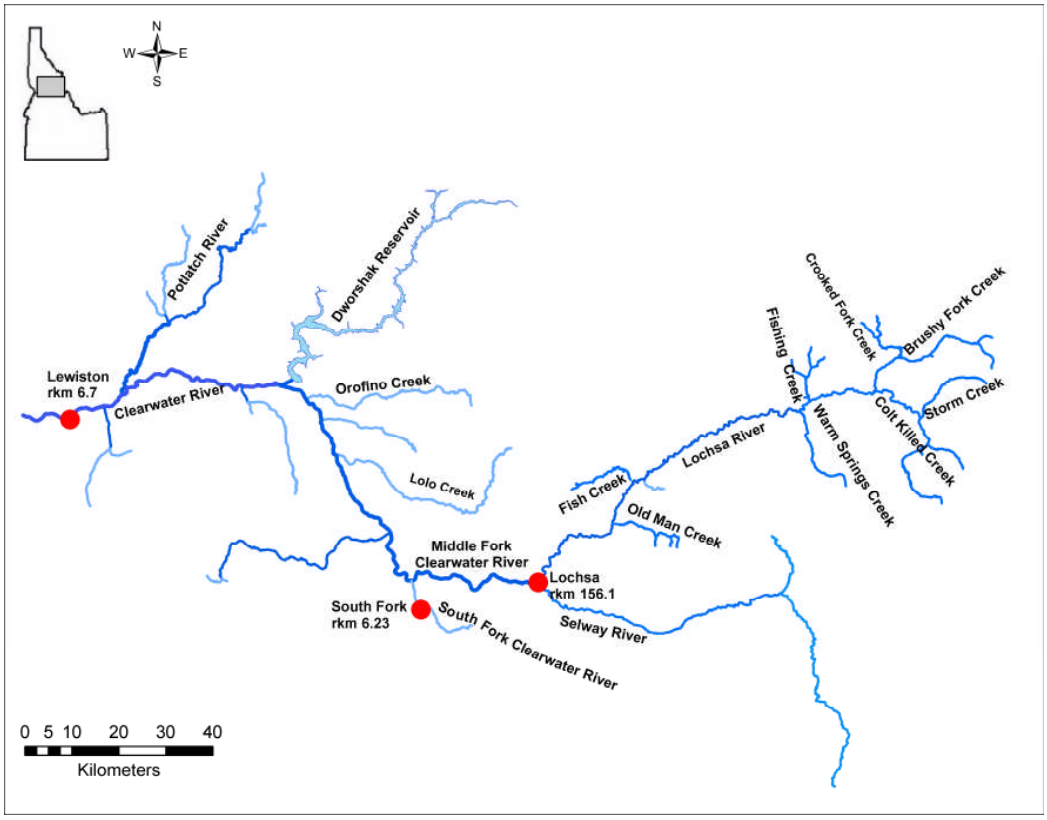

Figure 1. Overview map of the Clearwater, South Fork Clearwater, and Lochsa River drainages including major tributaries. Fixed telemetry site locations are indicated in red, they are located at the following rkm: Lewiston 6.7 (CWR), Kooskia 6.23 (South Fork) , and Lochsa 156.1 (Middle Fork).

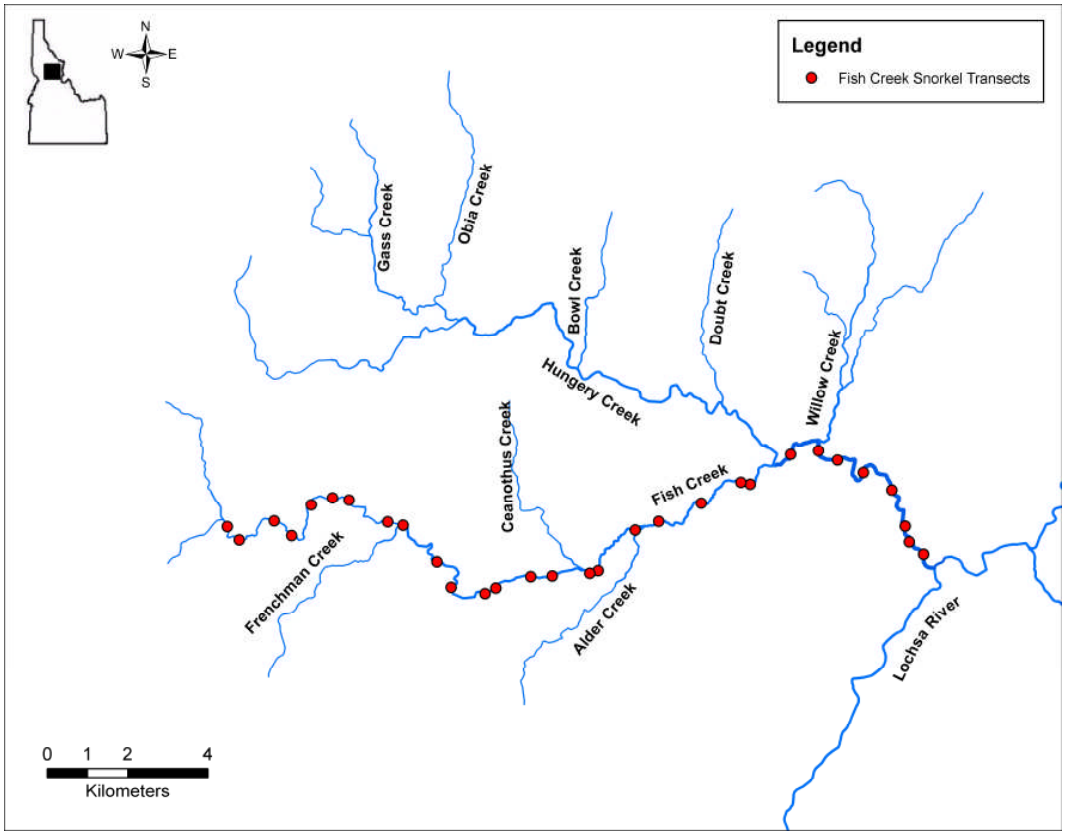

Figure 2. Fish Creek Drainage overview map including major tributaries. Circles indicate relative snorkel transect positions throughout the drainage

METHODS

Tagging

Bull trout were captured with hook-and-line in the Lochsa River between 2 April 2004 and 12 June 2004. Sampling was conducted in the Lochsa between rkm 164.9 and rkm 247.2 (Figure 3). Individual bull trout were anesthetized. All fish were scanned for Passive Integrated Transponder (PIT) tags. If a fish was PIT-tagged the identification number was recorded, total and fork lengths and weight were measured. Then the fish was put in freshwater for 15 minutes prior to being released. If a fish was not previously PIT tagged the following procedure was completed. A 134 kHz PIT tag was inserted in the opercula muscle using a 14-guage hypodermic needle. Fish were weighed and total and fork lengths were measured. Each fish's adipose was clipped for genetic sampling and for future identification. The leading pelvic fin ray was collected from each fish to determine age.

Bull trout weighing greater than 455 g were candidates for surgical radio transmitter implantation. The surgical procedure is an adaptation of the shielded-needle technique as described by Schill et al. (1994). All individuals were allowed to recover in fresh water for a minimum of 15 minutes prior to release.

We utilized MCFT-3EM (MICRO) radio transmitters (Lotek Engineering). MICRO radio transmitters are 11 mm x 49 mm, weigh 8.9 g in air, 4.3g in water, and have a life expectancy of at least 399 days. We used transmitters in the frequency 149.460 MHz. Each transmitter had a code associated with it ranging from 168 to 208. We will use a frequency-code combination to identify individual fish throughout this document. For example: a fish tagged with a transmitter in the 149.460 MHz frequency with a code of 200 will be shown as 149.46.200.

Fish with radio transmitters implanted were also subject to maturity and sex determination. An otoscope was used to visually determine gender and maturity. An otoscope was inserted into the incision created for transmitter implantation. Once inserted into the body cavity, mature reproductive organs, if present, were readily observed. If no reproductive organs were observed, the otoscope was moved down the body wall dorsally and anteriorly toward the head, following the kidney. Immature reproductive organs were generally found lying along the body wall posterior to the liver. If no reproductive organs were observed, it was recorded as unknown. A female was determined to be mature if eggs greater than one mm diameter were observed and immature if eggs less than one mm diameter were observed. A male was identified as mature if large gonads were observed and immature if gonads were small and undeveloped.

Tracking and Distribution

The Department and University of Idaho coordinated tracking efforts during the 2004-tracking year. Automobiles and fixed-wing aircraft were utilized on a monthly basis to monitor fish in the Lochsa, Middle Fork Clearwater, North Fork Clearwater below Dworshak dam, and Clearwater rivers. In addition to mobile tracking we utilized three established stationary radio-receiving sites, maintained and operated by the University of Idaho. The Lochsa fixed site was located at the confluence of the Lochsa and Selway rivers at rkm 156.2, at Lowell, Idaho. The South Fork fixed site was located at rkm 119.5 at Kooskia, Idaho. The Lewiston fixed site was located at rkm 6.7, approximately 3.0 km upstream of Lewiston, Idaho (Figure 1).

Stream Survey

Snorkeling techniques were used to document fish distribution and abundance in Fish Creek. Transects to be sampled were selected using a stratified random sampling design. Transects were selected by delineating each km of stream into ten, one hundred meter sections. One, 100 meter transect per kilometer was randomly selected. The coordinates for each transect were obtained from MapTech (MAPTECH 2002). At each transect a minimum of 100 m was snorkeled, beginning and ending at natural habitat breaks. Transects were snorkeled throughout daylight hours. All fish observed were identified to species and their size estimated to the nearest inch. Physical stream characteristics including temperature, visibility, percent habitat type, three stream widths and transect length were recorded for each transect. Stream widths and the length were used to calculate the surface area for each transect (mean width (m)* length (m) = Area (m) ^{2}). The density of each fish species per 100 m^2 was estimated using the following equation: number of fish observed per species/stream area*100.

We used the randomly selected snorkel transects to expand the transect density estimates into a population estimate. Fish populations (by species) were estimated by multiplying the average density of fish observed in transects from each stream kilometer by the estimated surface area of stream in each kilometer. Individual kilometer population estimates were added together to estimate the total population. Stream surface area in each kilometer

was estimated by multiplying the average stream width by 1,000 m. Average width for each kilometer of stream was calculated using actual measurements taken in the randomly chosen snorkel transects from each kilometer (Table 1). We assume the average fish density and average stream width for each respective stream kilometer is representative of the entire kilometer because they were chosen randomly.

Table 1. Formulas used to calculate the population estimate from stratified random snorkeling transects.

Equation 1:	Average width per km = Σ Width…/Number of Widths
Equation 2:	Area Surveyed per km = Equation 1 * Length $_{(xi)}$
Equation 3:	Area per km = Equation 1 * 1000 m
Equation 4:	Density of Fish Species Y in Surveyed Area per Transect = Total number of Fish Species Y observed / Equation 2
Equation 5:	Fish Species Y per km = Equation 3 * Equation 4
Equation 6:	Total Number of Fish Species Y in stream = Σ Equation 5_{xi}

RESULTS

Tagging

From 2 April to 12 June 2004, 43 bull trout were collected in the Lochsa River (Table 2). Total length of all bull trout collected ranged from 330 mm to 568 mm (mean 444.5 mm) (Figure 4, Table 2) and weight ranged from 330 g to 1,810 g (mean 898.6 g) (Figure 5). Radio transmitters were implanted in 41 bull trout. Two fish were not radio-tagged; one was too small, the other was injured during collection. It is believed that three fish died due to the tagging procedure (Table 3). This is because these fish moved only a short distance upstream, less than 2 km, or only downstream after tagging (Table 3).

Life History Information

Length-Weight Relationship

The length-weight relationship for bull trout captured in the Lochsa River was described by the equation log weight (g) = 3.1355 log total length (mm) – 5.3657. Schiff and Schriever (2003) obtained a value of log weight (g) = 3.5551 log total length – 5.327.

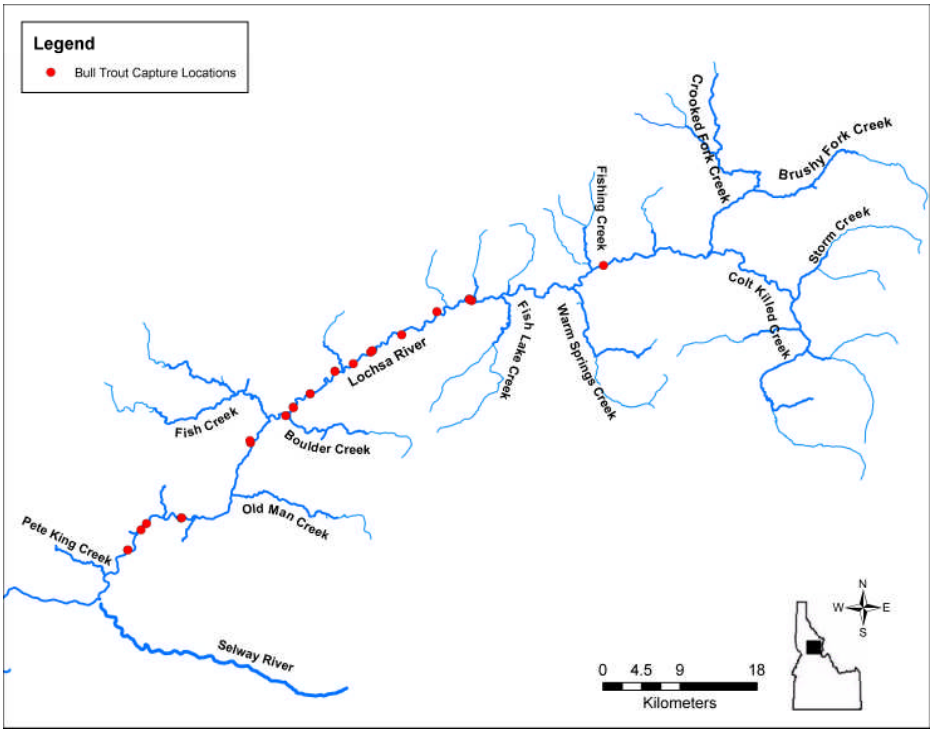

Figure 3. Bull trout capture locations in the Lochsa River, 2004.

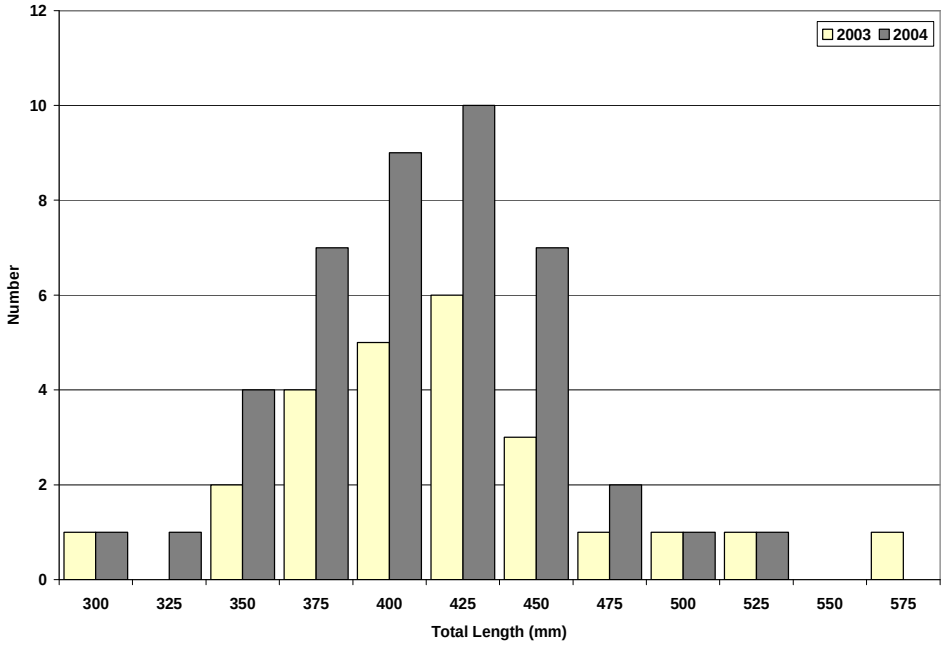

Figure 4. Bull trout total length distribution for fish captured in the Lochsa River, 2003 and 2004.

Table 2. Bull trout statistics for total length and weight for all fish captured in the Lochsa River drainage, 2004.

	Total Length	Weight
Mean	444.5	898.6
Median	449	870
Mode	475	860
Standard Deviation	48.1	300.2
Sample Variance	2,309.4	90,111.1
Minimum	330	330
Maximum	568	1,810
Number Captured	43	43

Table 3. Radio-tagged bull trout distribution and spawning survival comparison by tributary in the Lochsa River drainage, 2003 and 2004.

Drainage	Number of Fish (2004)	Percentage of Total Radio-Tagged Fish (2004)	Number of Suspected Shed Transmitters or Fish Mortalities (2004)	Percent Survival of Radio-Tagged Fish (2004)	Percentage of Total Radio-Tagged Fish (2003)	Percent Survival of Radio-Tagged Fish (2003)
Brushy Fork Creek	4	11%	2	50%	13%	50%
Colt Killed Creek	11	29%	2	82%	31%	80%
Crooked Fork Creek	4	11%	2	50%	NA	NA
Fishing Creek	8	21%	1	88%	19%	0%
Storm Creek	6	16%	2	67%	25%	25%
Warm Springs Creek	1	3%	0	NA	13%	100%
Lochsa, Mainstem	4	11%	0			
Tagging or Post-Tagging Mortality	7					
Total	45		9	76%		69%

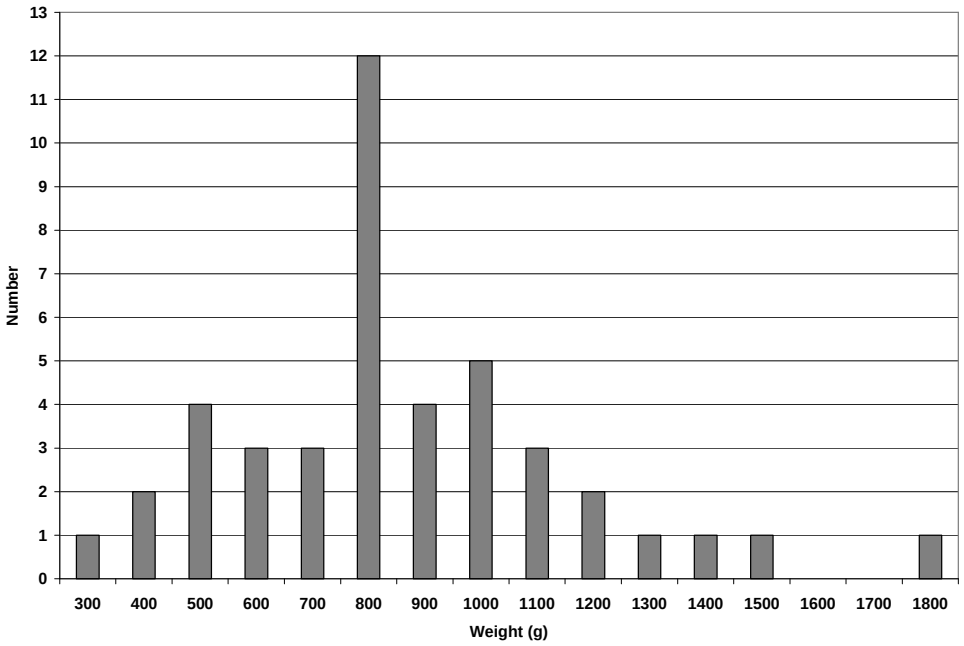

Figure 5. Bull trout weight range distribution for fish captured in the Lochsa River, 2004.

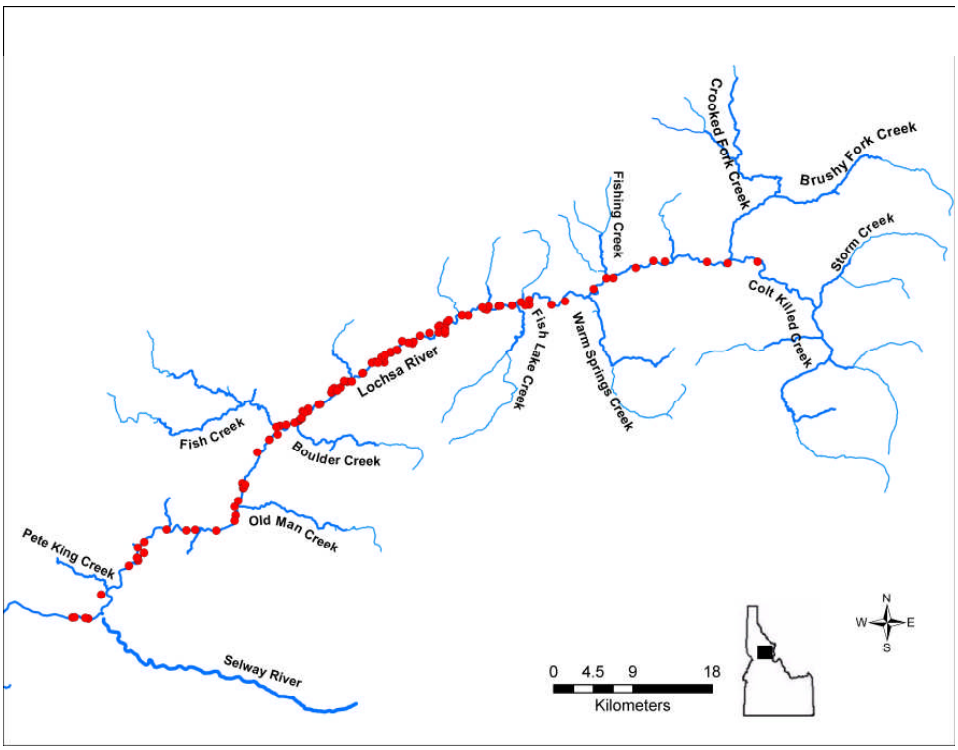

Figure 6. Radio-tagged bull trout distribution during the migration time period, 1 April – 30 June 2004.

Sex Ratio and Maturity

Maturity and sex was determined in 41 of the 43 fish collected in the Lochsa River. There were 23 males and 18 females, all were determined to be mature. The sex ratio obtained was 1.28 males per female.

Migration and Spawning Periods

Four post-spawn fish were radio-tagged post-spawn in 2003 in the Lochsa River (Schiff et al 2005). Their vital statistics were reported in 2003; however their migration pattern will be included with the fish tagged in 2004. In the summer of 2004, 38 of the 45 radio-tagged fish were detected migrating from their original tagging location. The migration time period was delineated from 1 April – 30 June 2004. During the migration period 43 fish tagged in 2004 and an additional six fish tagging in 2003 were detected (Figure 6). The majority of fish were detected in the mainstem Lochsa River. Radio-tagged fish migrated extensive distances, some exceeding 100 km, during this time period from overwintering and tagging locations (Table 4, Appendix 1 Table 1). A single fish, 149.46.192, was detected entering a tributary, Colt Killed Creek, during the migration period on 22 June 2004 (Figure 6).

During the spawning period 41 individual fish were detected, all were tagged in 2004. The majority of these detections were located in the following tributaries to the Lochsa River: Brushy Fork Creek 4 (11%), Colt Killed Creek 11 (29%), Crooked Fork Creek 4 (11%), Fishing Creek 8 (21%), Storm Creek 6 (16%), Warm Springs Creek 1 (3%), and Lochsa mainstem 4 (11%) (Figure 7, Table 3). Three of the fish distributed in the mainstem Lochsa were located at the mouth of potential spawning tributaries. They were located at the mouth of Indian Graves, Fishing and Weir creeks, respectively (Figure 7). The other fish remaining in the Lochsa mainstem was located between Badger and Wendover creeks, an area not thought to be associated with spawning activity.

Fish 149.46.201 was tagged on 14 May 2004 at rkm 176.6 and was detected on 22 June 2004 at rkm 152.1, approximately 24.5 km downstream (Table 3). Fish 149.46.201 was not detected moving after 22 June 2004. It was believed to be a mortality, but it is not known if it was tagging related, angling, poaching or predation. Fish 149.46.201 was excluded from the mean migration calculation.

Fish 149.46.184 was last detected on 23 July 2004 near the weir at the Powell Satellite Hatchery Facility (rkm 270.2). This weir was in operation to capture returning adult Chinook salmon (*Oncorhynchus tshawytscha)*. The bull trout was found dead in the weir shortly after its last radio detection date. Prior to this point, the fish had migrated a distance of 105.3 km upstream from its tagging location (Table 3). Due to these circumstances this fish was also excluded from the mean migration calculation. All other fish that were suspected to be tagging or post-tagging related mortalities were excluded from mean migration distance calculations (Table 3).

Radio-tagged bull trout in the Lochsa drainage were observed migrating a mean upstream distance of 74.4 km (25.3 km - 124.1 km). The first radio-tagged bull trout was detected in a known spawning tributary on 22 June 2004; and the last on 23 September 2004. The three previously mentioned mainstem Lochsa fish may have entered a spawning tributary for a short duration to spawn, however they were not detected due to our biweekly tracking schedule.

Overwintering Periods

The first overwintering time period extended from October 2003 through March 2004. Tracking was conducted at least twice per month from October through December, then only once per month from January through March. Seventeen radio-tagged fish were detected at least once during the October – December 2003 time period (Figure 8). These fish were distributed between 150.5 rkm and 249.3 rkm, Lodge and Warm Springs creeks (Figure 8). The majority of fish were distributed between 199.1 rkm and 229.1 rkm, Boulder and Indian Graves creeks (Figure 8). Fish first appeared at overwintering locations on 15 October 2003.

The second overwintering time period was from October – December 2004. Tracking was conducted only once per month during this period. Twenty-seven radio-tagged fish were detected at least once. These fish were distributed from 148.7 – 109.6 rkm, above Smith Creek and below Cliff Creek (Figure 10). The majority of fish were distributed between 199.1 rkm and 229.1 rkm, Boulder and Indian Graves creeks (Figure 10).

Thirteen fish were detected at least once from January – March 2004 (Figure 9). The radio-tagged fish were distributed from 225.9 rkm to 154.8 rkm, above Lost Creek to below the Lochsa-Selway confluence. However, the majority of fish were concentrated between the Selway-Lochsa confluences and upstream to Old Man Creek, rkm 157.1 – 184.6 (Figure 9).

Spawning Mortality

Seventy-six percent (29/38) of the radio-tagged fish were detected returning to the mainstem Lochsa River post-spawn. The remaining fish either shed their transmitters, or succumb to mortality. Fish survival/tag retention broken out by spawning tributary was as follows: Brushy Fork Creek 50% (2/4), Colt Killed Creek 82% (9/11), Crooked Fork Creek 50% (2/4), Fishing Creek 88% (7/8), Storm Creek 67% (4/6), and Warm Springs Creek 100% (1/1) (Table 3).

Fish Creek

Relative Abundance and Distribution

Thirty randomly selected transects were snorkeled in the mainstem of Fish Creek drainage from 9 - 25 July 2004, no tributaries were snorkeled (Figure 2). Bull trout were not observed in any transect. Steelhead/rainbow trout (*Oncorhynchus mykiss*) were the most abundant species observed. A total of 2,375 steelhead/rainbow trout were observed with a mean density of 7.77 fish/100m^2 (range 0.12 - 24.24) (Table 5). Steelhead/rainbow trout densities were greater than 10.00 fish/100m^2 in the first 11 km of the stream (Table 5). The highest density was 24.24 fish/100m^2 in transect 1.6 (Table 5). The rainbow trout population is estimated at 24,417 fish (CI +/-1,875.5, Table 5). All rainbow trout observed were less than 305 mm in length.

A total of 722 Westslope cutthroat trout (*O. clarkii*) were observed with a mean density of 3.98 fish/100m^2 (0.13-14.91 fish /100m^2) (Table 5). Cutthroat trout densities were highest in transects 25.3 and 28.7, where densities were 14.42 fish/100m^2 and 14.91 fish/100m^2, respectively (Table 5). The cutthroat trout population was estimated at 7,337 fish (CI +/- 394.8, Table 5). Only four cutthroat trout observed were greater than 305 mm in total length, these fish were located in the lower three kilometers of Fish Creek (Table 5).

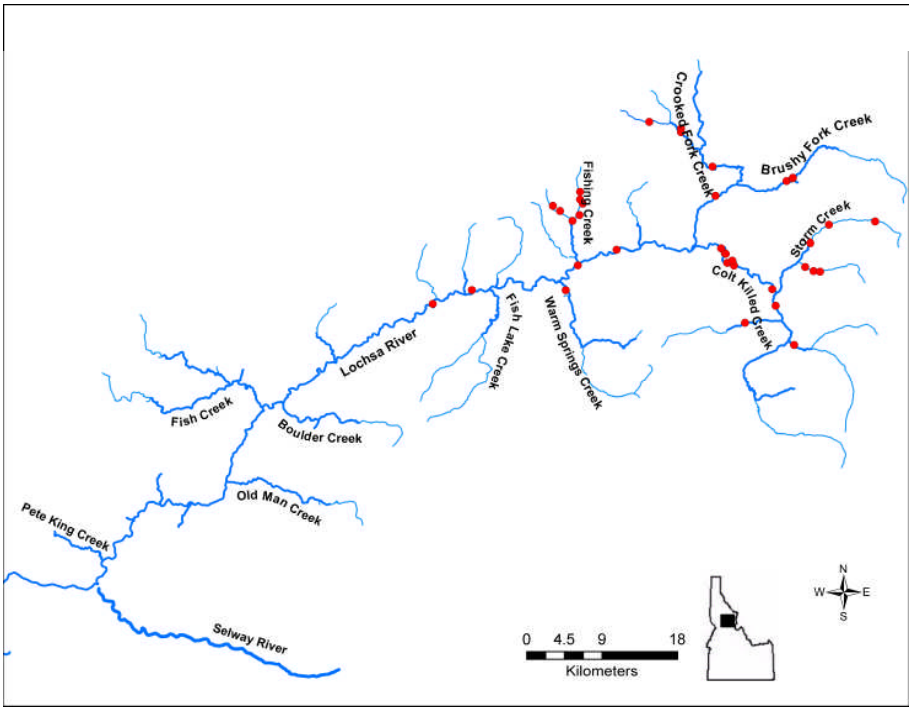

Figure 7. Radio-tagged bull trout distribution during the spawning time, 15 August – 30 September 2004. For simplification purposes each fish is displayed once during this time frame.

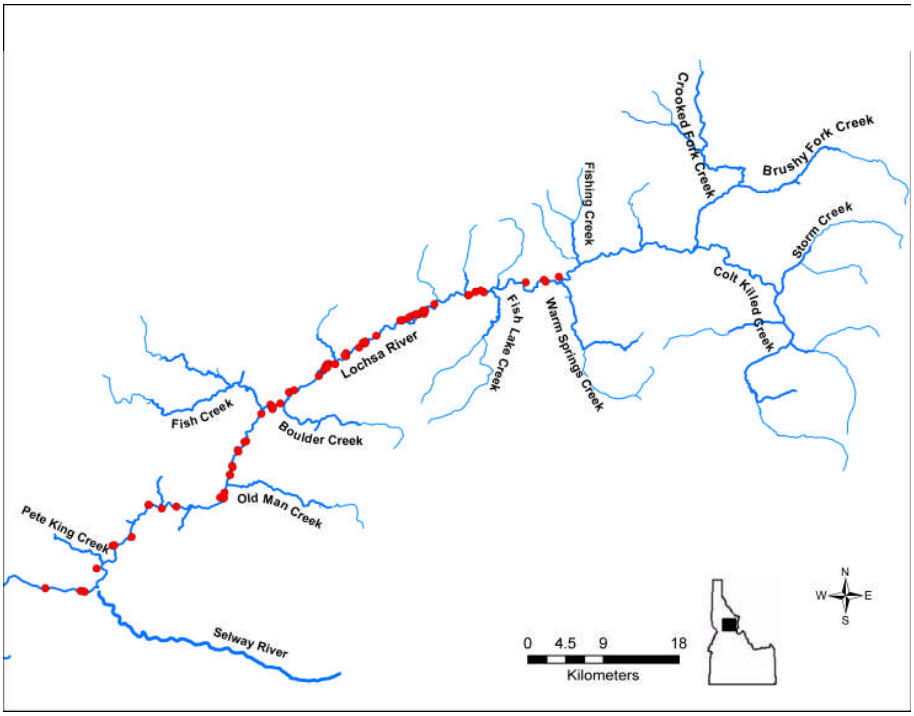

Figure 8. Radio-tagged bull trout distribution during the overwintering period, 1 October – 30 December 2004. An individual fish is displayed more than once if detected multiple times during the time frame.

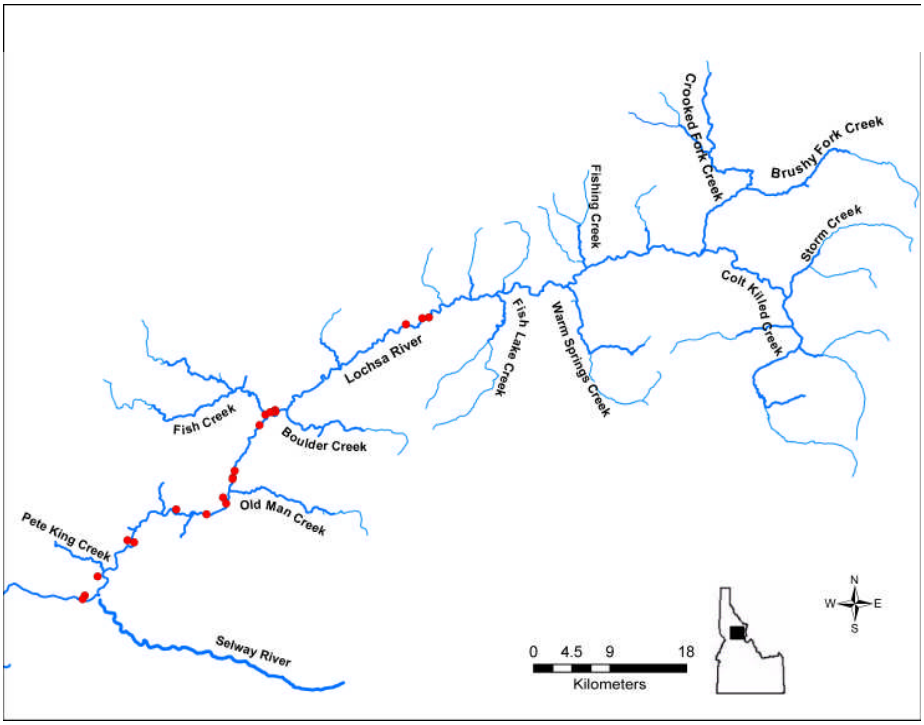

Figure 9. Radio-tagged bull trout distribution during the overwintering period, 1 January – 31 March 2004. An individual fish is displayed more than once if detected multiple times during the time frame.

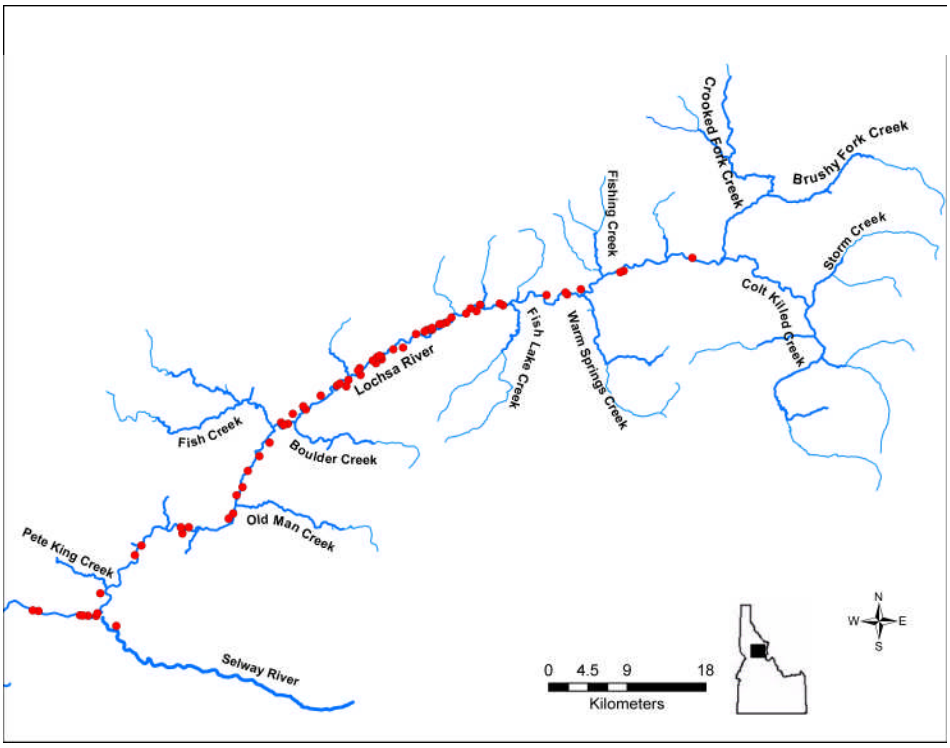

Figure 10. Radio-tagged bull trout distribution during the overwintering period, 1 October – 30 December 2004. An individual fish is displayed more than once if detected multiple times during the time frame.

Table 4. Mean bull trout migration distances (km) for radio-tagged fish grouped by spawning watershed in the Lochsa River drainage, 2004. Fish suspected to be tagging or post-tagging mortalities were grouped together and their migration distances were not included in the average migration distance for all radio-tagged fish. Negative numbers indicate downstream movement.

	Colt Killed Creek	Crooked Fork Creek	Fishing Creek	Lochsa, River	Storm Creek	Warm Springs Creek	All	Post-Tagging Mortalities	Tagging Mortalities
Mean	79.4	89.9	58.5	44.6	85.0	46.6	73.3	34.4	-7.9
Standard Error	6.2	13.6	2.5	10.9	7.9	0.0	3.8	23.7	8.4
Median	85.3	88.8	59.7	38.9	82.5	46.6	72.1	12.8	-1.2
Standard Deviation	20.4	27.3	7.0	21.7	19.3		23.3	47.4	14.5
Sample Variance	418.2	743.1	49.7	471.5	373.8		543.7	2,245.8	209.2
Minimum	40.1	57.8	47.9	25.3	61.0	46.6	25.3	6.8	-24.5
Maximum	111.7	124.1	71.0	75.5	116.8	46.6	124.1	105.3	2.0
Sample Size	11.0	4.0	8.0	4.0	6.0	1.0	38.0	4.0	3.0

Table 5. Salmonid density and population estimates in Fish Creek, 2004.

		Westslope Cutthroat Trout				Steelhead/Rainbow Trout	
Transect	Area(m^2)	<305 mm Per 100m^2	>305 mm Per 100m^2	Total Fish Per 100m^2	Estimated Fish Per km	<305 mm Per 100m^2	Estimated Fish Per km
0.8	1,536.8	0.13		0.13	19.7	18.41	2,780.6
1.6	1,431.7	0.28	0.14	0.42	65.8	24.24	3,805.2
2.4	1,238.1	0.48	0.08	0.56	71.2	13.97	1,760.6
3.1	1,038.0	1.45	0.10	1.55	177.3	11.75	1,351.6
4.4	1,070.0	0.75		0.75	74.8	16.17	1,616.8
5.7	1,176.0	0.43		0.43	51.0	14.63	1,755.1
6.2	1,500.0	0.13		0.13	20.0	15.20	2,280.0
7.2	1,171.7	1.20		1.20	283.4	10.07	1,238.7
8.8	911.7	0.33		0.33	48.3	10.53	926.6
9.1	872.2	0.35		0.35	33.7	10.24	1,000.0
10.3	532.7	2.06		2.06	117.7	19.67	1,102.1
11.7	744.8	4.97		4.97	275.5	15.84	1,204.1
12.8	1033.6	1.16		1.16	117.3	3.39	342.0
13.9	567.5	4.23		4.23	215.7	6.87	350.5
14.2	491.9	2.85		2.85	148.0	3.06	158.6
15.7	656.3	1.98		1.98	120.8	6.55	399.7
16.5	609.0	1.48		1.48	100.5	8.21	558.3
17.5	777.0	5.02		5.02	351.4	2.70	189.2
18.0	982.8	4.58		4.58	494.5	3.15	340.7
19.7	622.5	7.39		7.39	502.5	5.00	338.6
20.1	711.0	6.75		6.75	533.3	2.40	188.9
21.5	777.6	4.24		4.24	343.8	6.04	489.6
22.8	406.4	11.07		11.07	465.1	0.74	31.0
23.8	810.2	3.58		3.58	264.9	0.12	9.1
24.4	611.2	4.09		4.09	261.8	0.33	20.9
25.3	575.7	14.24		14.24	821.8	0.52	29.7
26.7	492.8	6.29		6.29	276.8	0.41	17.9
27.7	594.0	3.70		3.70	222.2	0.51	30.3
28.7	382.2	14.91		14.91	581.6	1.57	61.2
29.7	312.8	8.97		8.97	277.5	1.28	39.6
			Population Estimate		7,337.7		24,417.3
			95% CI (+/-)		394.8		1,875.5

DISCUSSION

Tagging

There was a 7% (3/41) loss of radio-tagged fish due directly to the tagging procedure. Tagging mortality is always a factor considering the relatively extensive procedure the fish undergo. We felt an acceptable loss due to tagging mortality was 10% or less. Therefore, we did not have an excessive loss of fish due to the tagging procedure.

There was not a significant difference in the mean size of bull trout captured in the Lochsa River from 2003 to 2004 (p-value 0.28). However, there was an increase in the dominant size range of fish captured. In 2003, 44% of the fish captured were in the 400 – 449 mm total length range (Figure 4). In 2004, this size range accounted for 37% of the bull trout captured. The majority, 40%, of fish captured were in the 450 – 499 mm total length range.

Life History Characteristics

Sex Ratio

There was not a significant difference is the sex ratio observed in 2004 compared to 2003. In 2003 the ratio was 1.25 males per female (Schiff et al. 2005), compared to 1.28 males per female in 2004.

Migration

The majority of radio-tagged fish in 2003 and 2004 entered the Colt Killed Creek drainage. Storm Creek, a large tributary to Colt Killed Creek, had the second highest percentage of radio-tagged fish in 2003 and the third highest in 2004. These two drainages accounted for 56% and 45% of the known spawner locations in 2003 and 2004, respectively. This information suggests that this area is a stronghold for bull trout in the Lochsa River basin.

Another strong fluvial bull trout spawning area is located in Fishing Creek. We have documented approximately 20% of the radio-tagged spawners in the Lochsa River basin annually. Fishing Creek is a relatively small drainage, 6,957 ha. There is consistently bull trout redds and spawners observed, the average since 1994 is 28 redds. In 2004, there were 83 redds observed, the highest number of redds for any surveyed stream section in the Lochsa or North Fork drainages (Pat Murphy Clearwater National Forest, Forest Fisheries Biologist, personal communication).

Overwintering migration patterns are different between bull trout in the Lochsa and those in the North Fork/Dworshak Reservoir. Fish move throughout Dworshak Reservoir during the overwintering period. It is common for a single fish to move weekly into different areas of the reservoir. At times the different areas are over 16 km from each other (Schiff et al. in press). This is dramatically different than overwintering patterns observed in the Lochsa River.

Generally, bull trout in the Lochsa River move to an overwintering area in October and remain there through April.

Spawning Mortality

Post-spawn survival was 76% in 2004, this is comparable to 69% documented in 2003 (Schiff et al. 2005). The Lochsa River bull trout population's annual survival appears to be more stable than that observed in the North Fork population. Schiff et al. (2005) reported survival rates in the North Fork bull trout population varying from 31% to 82% from 2001 – 2003. However, in 2003 when survival is reported for both areas survival was higher in the North Fork compared to Lochsa (Schiff et al. 2005), 82% and 69%, respectively. Conversely, in 2004 survival in the North Fork was 66%, 10% lower than in the Lochsa River. Therefore, the Lochsa River population could have had low survival in 2001 and 2002, similar to the North Fork, but it was not documented.

Fish Creek

Steelhead/rainbow trout densities were highest in the lower reaches of the drainage. Additionally the steelhead/rainbow trout were all less than 305 mm in total length.

The survey area extended from the mouth of Fish Creek until it was no longer efficient to snorkel and identify fish. Bull trout have been observed in Fish Creek as part of an annual parr monitoring project in an adult weir, juvenile screw trap, and in snorkel monitoring sites (A. Burne, IDFG Fisheries Research Biologist, personal communication). These monitoring efforts are all completed in Fish Creek below Hungery Creek. This survey did not observe bull trout in 30 transects snorkeled in Fish Creek. This would indicate bull trout are low in numbers and their distribution is sporadic. However, only the mainstem Fish Creek was surveyed. Bull trout are known to occupy small first and second order streams. There are several potential fish bearing streams of this size that flow into Fish Creek. Therefore, there is the potential for bull trout to exist in the Fish Creek drainage. Until the larger tributaries are surveyed it is unknown the complete distribution and abundance of bull trout in the drainage.

RECOMMENDATIONS

1. Colt Killed, Storm and Fishing creeks contain a large portion of the known fluvial bull trout spawning areas. Every effort should be made to protect the stream and riparian corridors in these drainages. These areas should be managed and protected to benefit bull trout.

2. To potentially identify bull trout distribution and abundance in a larger portion of the Fish Creek drainage, an additional survey specifically targeting larger fish bearing tributaries in the Fish Creek drainage would be beneficial. Specifically, it would be valuable to survey Hungery Creek. Hungery Creek is approximately equal in flow and drainage size (9,100 ha) to Fish Creek (9,341 ha) above their confluence. Hungery Creek has a high likelihood of containing bull trout.

ACKNOWLEDGEMENTS

We would like to thank the U.S. Forest Service, Clearwater National Forest for providing partial funding for this project.

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APPENDIX

Appendix A, Table 1. Radio-tagged bull trout distribution by spawning watershed, tagging and furthest upstream location, and total migration distance, in the Lochsa River drainage, 2004.

Frequency Code	Tagging Date	Spawning Watershed	Tagging Location (rkm)	Furthest Upstream (rkm)	Migration Distance From Tagging Location (km)
149.46.173	4/3/2004	Brushy Forks Creek	210.4	289.3	78.9
149.46.183	4/4/2004	Brushy Forks Creek	218.3	289.3	71.0
149.46.186	4/16/2004	Brushy Forks Creek	209.1	292.0	82.9
149.46.199	5/14/2004	Brushy Forks Creek	164.9	281.4	116.5
149.46.172	4/4/2004	Colt Killed Creek	214.9	276.7	61.8
149.46.181	5/16/2004	Colt Killed Creek	232.0	287.3	55.3
149.46.182	6/11/2004	Colt Killed Creek	247.2	287.3	40.1
149.46.188	4/17/2004	Colt Killed Creek	191.4	287.3	95.9
149.46.190	4/18/2004	Colt Killed Creek	199.1	292.8	93.7
149.46.191	4/18/2004	Colt Killed Creek	199.1	282.0	82.9
149.46.195	4/20/2004	Colt Killed Creek	199.1	285.5	86.4
149.46.198	5/16/2004	Colt Killed Creek	212.4	284.5	72.1
149.46.200	5/13/2004	Colt Killed Creek	209.1	294.4	85.3
149.46.205	4/23/2004	Colt Killed Creek	176.2	287.9	111.7
149.46.208	4/15/2004	Colt Killed Creek	199.1	287.3	88.2
149.46.170	4/2/2004	Crooked Fork Creek	203.8	296.2	92.4
149.46.174	4/3/2004	Crooked Fork Creek	210.4	295.5	85.1
149.46.180	5/16/2004	Crooked Fork Creek	232.0	289.8	57.8
149.46.202	5/14/2004	Crooked Fork Creek	176.2	300.3	124.1
149.46.168	4/2/2004	Fishing Creek	203.8	265.8	62.0
149.46.171	4/6/2004	Fishing Creek	199.1	253.5	54.4
149.46.178	5/17/2004	Fishing Creek	203.8	264.9	61.1
149.46.185	4/16/2004	Fishing Creek	203.8	262.8	59.0
149.46.187	4/16/2004	Fishing Creek	209.1	261.3	52.2
149.46.189	4/18/2004	Fishing Creek	199.1	259.4	60.3
149.46.194	4/19/2004	Fishing Creek	191.8	262.8	71.0
149.46.197	5/12/2004	Fishing Creek	214.9	262.8	47.9
149.46.169	4/3/2004	Lochsa River	203.8	229.1	25.3
149.46.176	4/6/2004	Lochsa River	199.1	234.7	35.6
149.46.196	4/23/2004	Lochsa River	176.2	218.3	42.1
149.46.207	4/15/2004	Lochsa River	178.0	253.5	75.5
149.46.177	4/6/2004	Storm Creek	199.1	294.1	95.0
149.46.179	6/12/2004	Storm Creek	232.0	293.0	61.0
149.46.192	4/18/2004	Storm Creek	232.0	304.0	72.0
149.46.193	4/18/2004	Storm Creek	214.7	297.4	82.7

Appendix A, Table 1, Continued.

Frequency Code	Tagging Date	Spawning Watershed	Tagging Location (rkm)	Furthest Upstream (rkm)	Migration Distance From Tagging Location (km)
149.46.203	5/16/2004	Storm Creek	212.4	294.7	82.3
149.46.206	4/23/2004	Storm Creek	176.2	293.0	116.8
149.46.175	5/17/2004	Warm Springs Creek	203.8	250.4	46.6
149.49.166*	11/17/2003	Post Tagging Mort	164.0	170.8	6.8
149.46.167*	11/17/2003	Post Tagging Mort	189.1	199.1	10.0
149.46.184	4/15/2004	Post Tagging Mort	164.9	270.2	105.3
149.46.204	4/15/2004	Post Tagging Mort	199.1	214.7	15.6
149.46.164*	11/15/2003	Tagging Mort	185.8	184.6	-1.2
149.46.165*	11/16/2003	Tagging Mort	189.1	191.1	2.0
149.46.201	5/14/2004	Tagging Mort	176.6	152.1	-24.5

* Fish were tagged post-spawn in 2003; migration information is combined into the 2004 data.

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